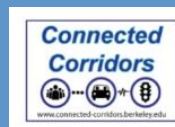




Connected Corridors Face-to-Face Meeting

Tuesday, Oct 27th, 2015 – 1:30 – 3:30 pm
Caltrans D7 HQ

Oct 27th, 2015



Agenda

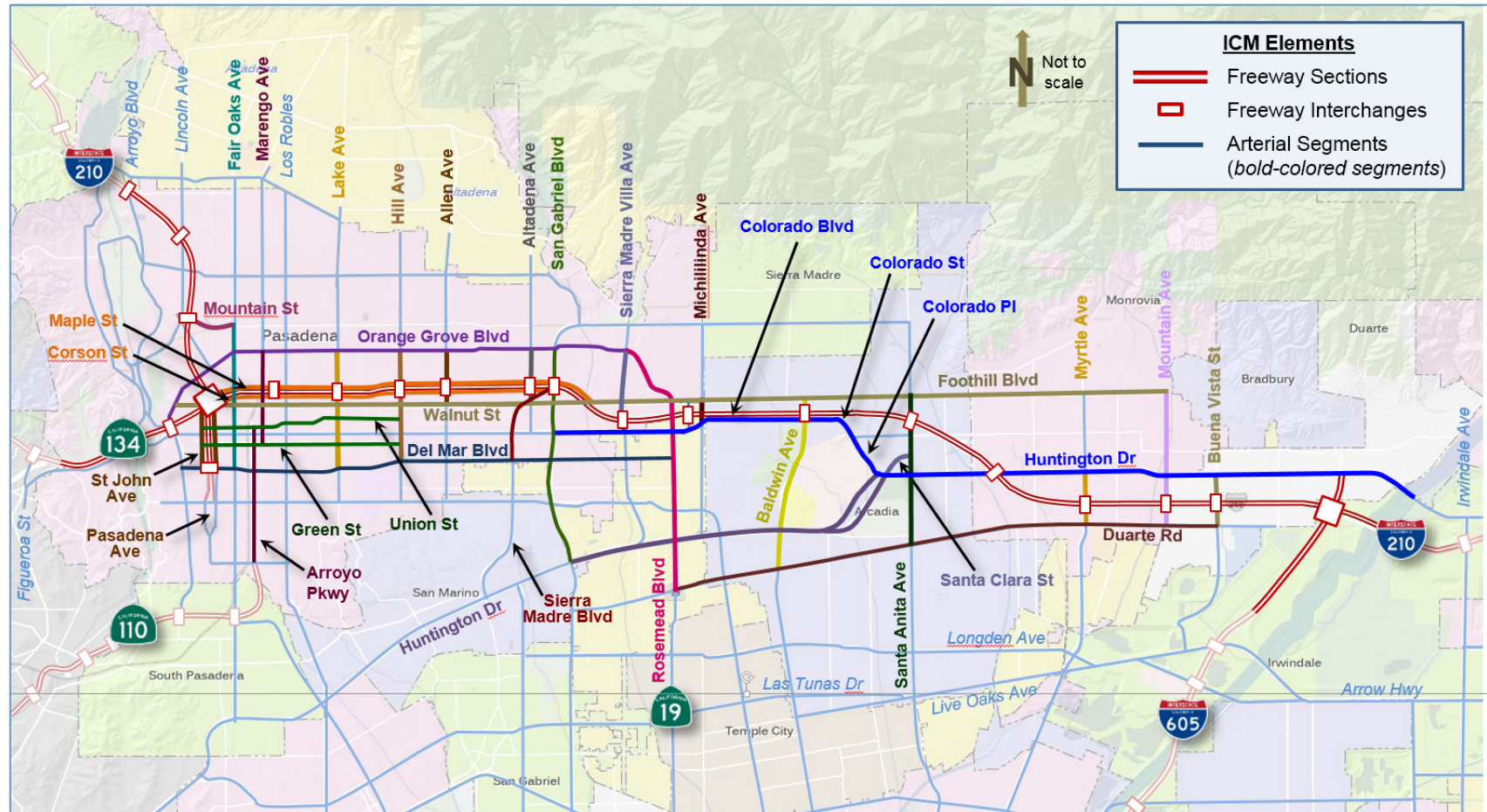
2

- **Introductions**
- **Schedule Review**
- **ICM Implementation**
- **Outreach**
- **Requirements Gathering**
- **Architecture and Constraints**
- **Decision Support and AMS**
- **Response Plans**
- **Evaluation Plan**
- **Action Items and Closing**



Our Corridor: The I-210

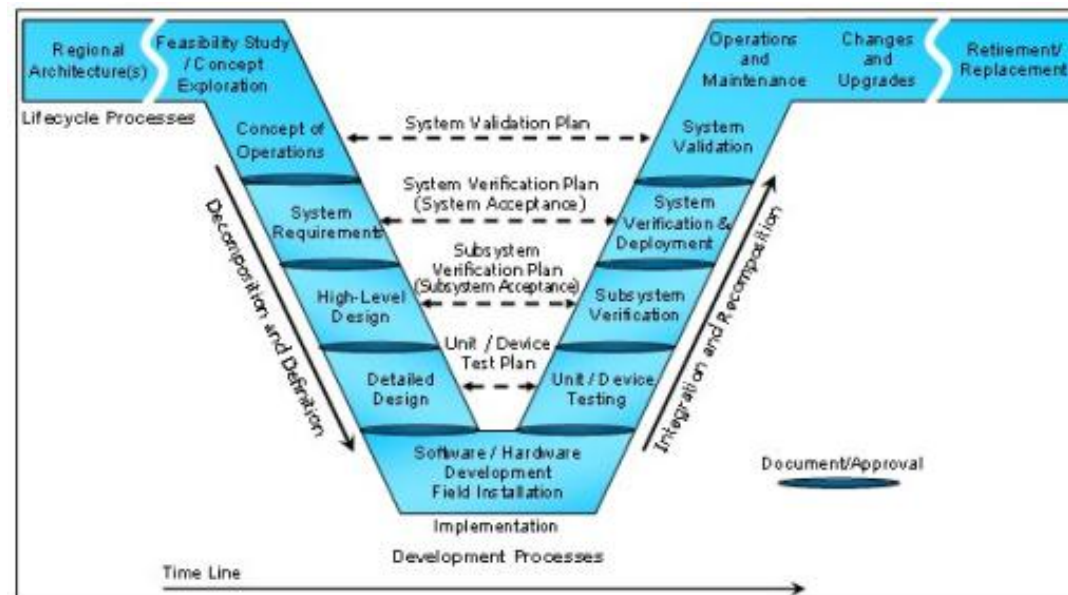
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System Engineering “Vee” diagram

4

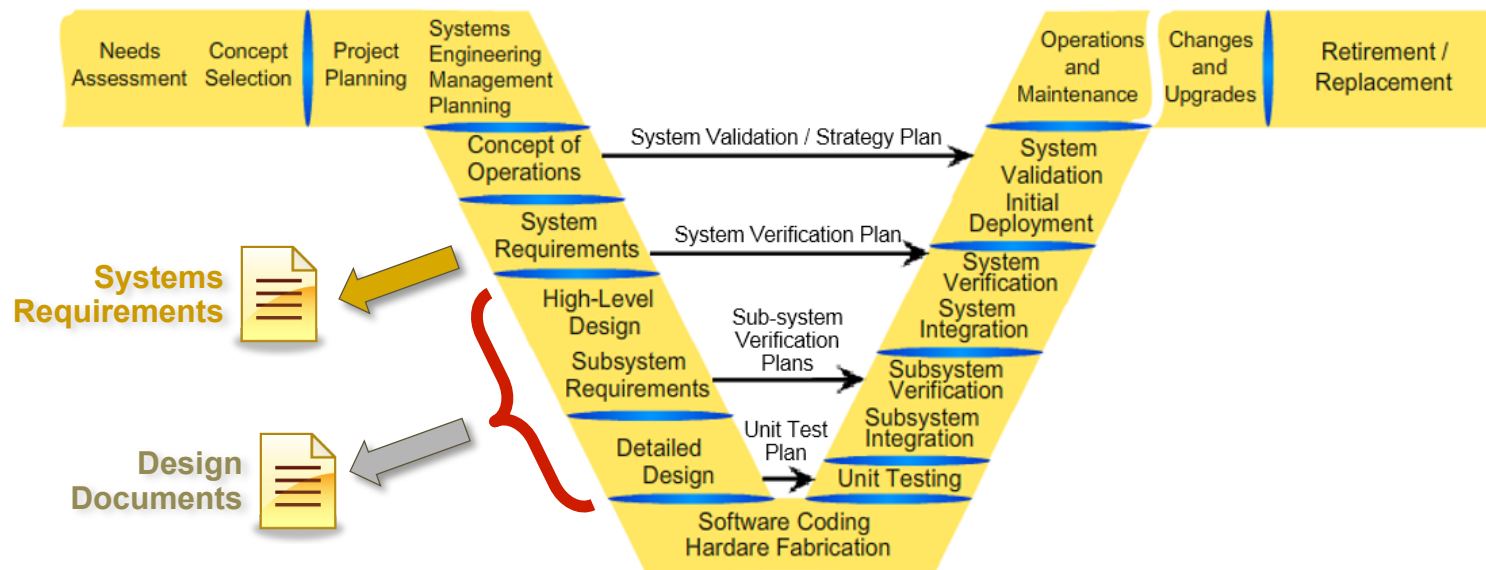
- **Planning:** **Resource Allocation and Concept Refinement**
- **Definition:** **Requirements, System Architecture and Response Strategies**
- **Build:** **System Implementation and Testing**
- **Operation:** **Deployment, Operation and Evaluation**



Systems Engineering Next Steps

5

- ❑ **Systems Requirements – What should the ICM system do**
- ❑ **Design Documents – How will the requirements be met**



I-210 Pilot - Status Summary

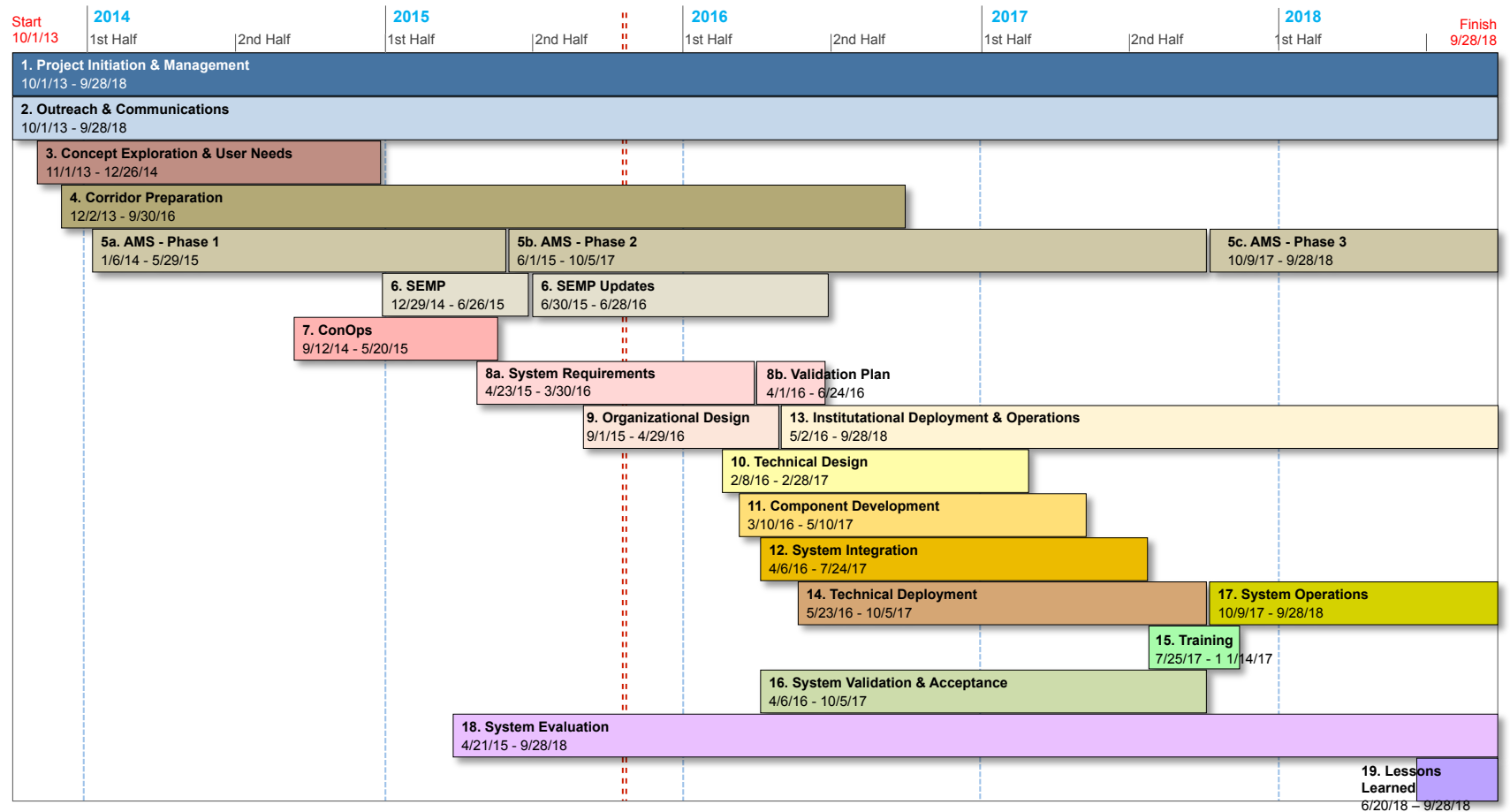
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- ▣ Metro board approved call for projects funding
- ▣ Requirements gathering in full swing
- ▣ Requirements approval date moved to March 2016
- ▣ Bi-Weekly meetings with Caltrans Office of Technology
- ▣ Response plan signal plan suggestions
- ▣ Evaluation plan ready for general review



I-210 Pilot Schedule

7



Caltrans Office of Technology



Caltrans HQ and the Requirements Process

- **Bi-weekly coordination meetings between Caltrans HQ and PATH**
- **Headquarters looking at statewide implications, supporting I-210 and reuse**
- **First area of focus is the Data Management function**
- **Headquarters is reviewing Dallas, I-15 ICM and I-80 Smart Corridor requirements to help in developing requirements for the Data Hub**



Data Management Hub

- ❑ **Data Hub contains the Extract, Transform, Load (ETL) as well as the archive and transaction databases.**
- ❑ **Several Commercial Off the Shelf (COTS) solutions for the ETL function**
 - ▣ We prefer inputs to the ETL to be in Transportation Management Data Dictionary (TMDD) format
 - ▣ Most commercial systems have this output option
 - ▣ Case by Case decision on where to transform to TMDD for legacy systems
- ❑ **Databases will store data in TMDD format**
- ❑ **Headquarters and PATH are working with D7 to reuse as much of the DCCM RSCS DSS as possible in the I-210**

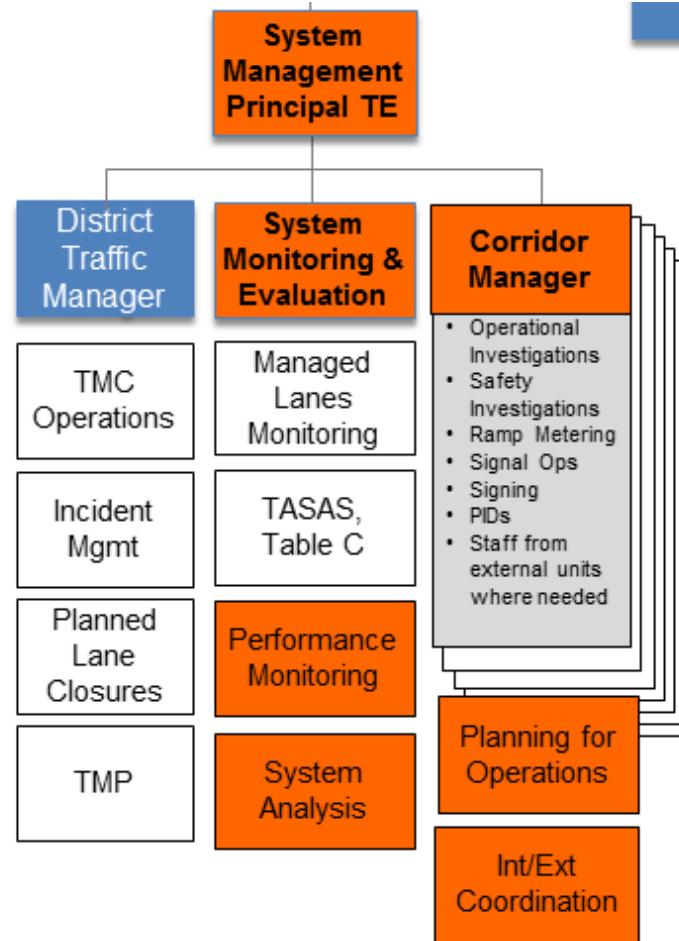


ICM Current Implementation



Caltrans Organization

12



ICM focusing on People and Organizations

13

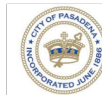
- ▣ ICM Requires
 - Data to know status of transportation network
 - Response plan choice
 - Implementation of response plan
- ▣ Long term - We plan on having
 - Significantly improved sensing and data communication infrastructure
 - A Decision Support System to assist with response plan choice
 - ITS elements capable of automatically accepting DSS generated response plan change requests
- ▣ Next Year – We plan to have
 - Improved sensing infrastructure and application of general knowledge by experienced personnel
 - Experienced personnel creating and selecting response plans
 - Personnel modifying ITS elements as needed to implement the response plan
- ▣ This is a good way to:
 - Continue to build relationships and trust
 - Ensure that automation occurs correctly
 - Have methods for dealing with situations that a DSS cannot handle



TIM Webinar hosted by NoCOE – Seattle

14

- ❑ Joint operation agreement is key, COOP with all agencies for Incident Response efforts within the CC.
- ❑ Main issue is lack of the sense of urgency! We need to have vehicles to respond quickly
- ❑ Legislation for Budget Authority is one recommendation from Seattle. We should do this!
- ❑ PD's working as TCO's have public safety training but lack traffic management training. As a result traffic clearance is not a priority.
- ❑ In our case, must understand how truck restrictions in Duarte and Monrovia will affect incident management and use of alternate routes
- ❑ We need to establish communication protocol on how, when and who will respond for incident management.
- ❑ Joint operation is needed for moderate operations as well from the LARTMC, just like we involve local PD's on Major events/Incidents.
- ❑ Get the tow company trained on what the TIM effort is about...
- ❑ We need to come up with an escalation diagram between each stakeholder



Outreach and Funding



Funding and Agreements

- ❑ **Metro Board approves Call for Projects Application for arterial improvements in September – excellent news!!!**
- ❑ **Letter of No Prejudice**
 - ▣ Drafting LONP and work scope for Caltrans D7 to sign
 - ▣ Early funding is not an issue – Metro able to get \$1.6M into FY 17 which starts July 1, 2016
- ❑ **Negotiations with Metro underway to determine most feasible way to proceed with procurement**
- ❑ **Next Agreement – Next Set of Agreements (MOU)**
 - ▣ Circulate draft document(s) before next face to face



Presentation to Jim Frazier – Chair of the Assembly Committee on Transportation

17

- **As part of a tour of ITS we presented on Connected Corridors**
 - ▣ We spoke highly of the Connected Corridors Program emphasizing the organizational changes and the successful partnerships
 - ▣ They enjoyed it, asking about additional funding and how they could help
- **At lunch there was extensive conversations with Janet Dawson – Chief Consultant for the Assembly Committee on Transportation**
- **I asked how to convey the meeting to you all today.**
- **“They enjoyed hearing about such a positive program and would like to hold a legislative hearing to showcase the program and the people who are working to make it successful”**
- **They also asked if we would advise on new ideas and technologies**



Outreach and Communications Activities

- Numerous articles mentioning Connected Corridors and new data
- Next *Connected* newsletter out soon
- CC Website: <http://connected-corridors.berkeley.edu>
- Conferences and Meetings
 - ▣ ITS California panel
 - ▣ IPAM presentation/panel
 - ▣ Joan and Nick to speak on 10/29 at Norther California ITS meeting



Foothill Gold Line Extension to Add Value and Complexity to I-210 Corridor

On September 23, the Pasadena to Azusa segment of the Foothill Gold Line extension reached substantial completion on time and on budget and was turned over to Metro for pre-revenue service. The Foothill Gold Line Construction Authority held a series of dedication ceremonies at each of the six new stations and the 24-acre Operations Campus located in Monrovia. "Reaching substantial completion is an important achievement for the entire team at the Construction Authority, Metro, and with our contractors and consultants," stated Construction Authority CEO Habib F. Balian. "We are proud to be the first light rail project funded by Measure R to have broken ground and to now be completed, and we look forward to handing the project over to Metro as they prepare to put the extension on-line in 2016."

The expansion of the Metro Gold Line will provide traveling commuters and local residents with more

opportunities and an alternative mode of transportation to mobilize throughout the county. In addition to enhancing the capacity along the I-210 corridor, the completed extension encourages sustainability, supports the reduction of greenhouse gas emissions, and promotes a more active transportation community. Residents will see added value to their community and have better connection access throughout the county. In addition to the light rail expansion, residents have seen vast improvements to bicycle and pedestrian accessibility.

With an expected daily ridership of ?? and anticipated transit oriented development creating new jobs and new tax revenue around the stations, the benefits of the extension are far reaching. In 2010, the Los Angeles Economic Development Corporation released

○ **Continued on page 2**



Monrovia Gold Line Station Dedication

Integrated Corridor Management Session at ITS CA



Stakeholder Celebration at ITS CA



IPAM Panel – Thank You!



Requirements



Requirements Gathering

□ Our “system”

- ▣ Composed of people, organizations, software and hardware
- ▣ All must work together to accomplish our goals
- ▣ Requirements must specify expectations for each component

□ Requirements gathering

- ▣ Both an educational and a definitional process
- ▣ Requirements are emergent from interactions among users
- ▣ How to gather emergent requirements?



Requirements: Data and Functions

25

□ Data

- ▣ Has Characteristics (Attributes) and Relationships to other data
- ▣ Is Known, Estimated, Unknown or Non-existent
- ▣ Has a level of quality/accuracy – Very important
- ▣ Is stored electronically, on paper or in a person's memory
- ▣ Is transmitted electronically, on paper or verbally by a person

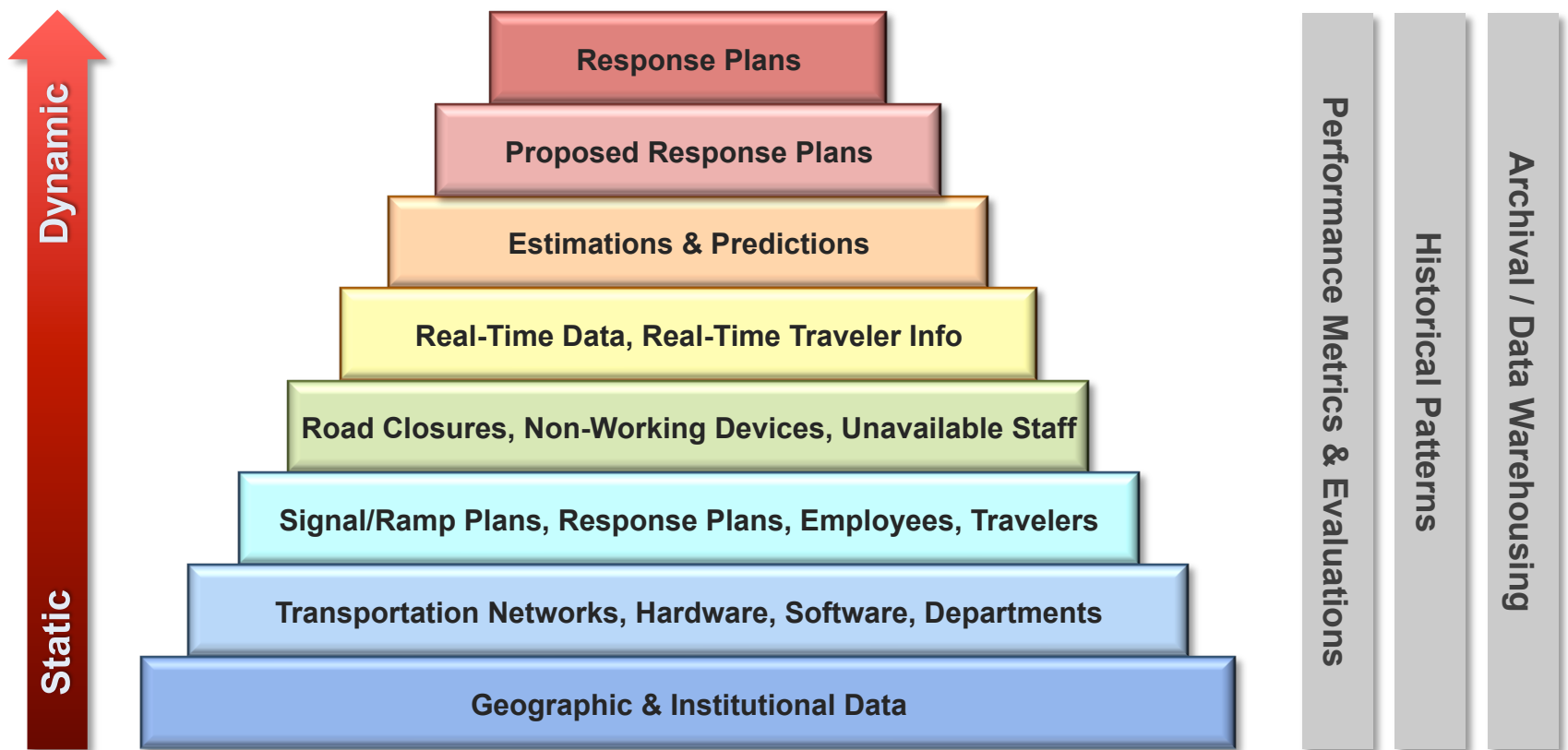
□ Functions

- ▣ Step by step instructions
- ▣ Execution in a certain order
- ▣ Decision Points (gates) determine execution order
- ▣ Executed electronically (Automated), semi-automated or manually
- ▣ Requires input data and generates output data



Data Requirements

26



Functional Requirements

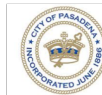
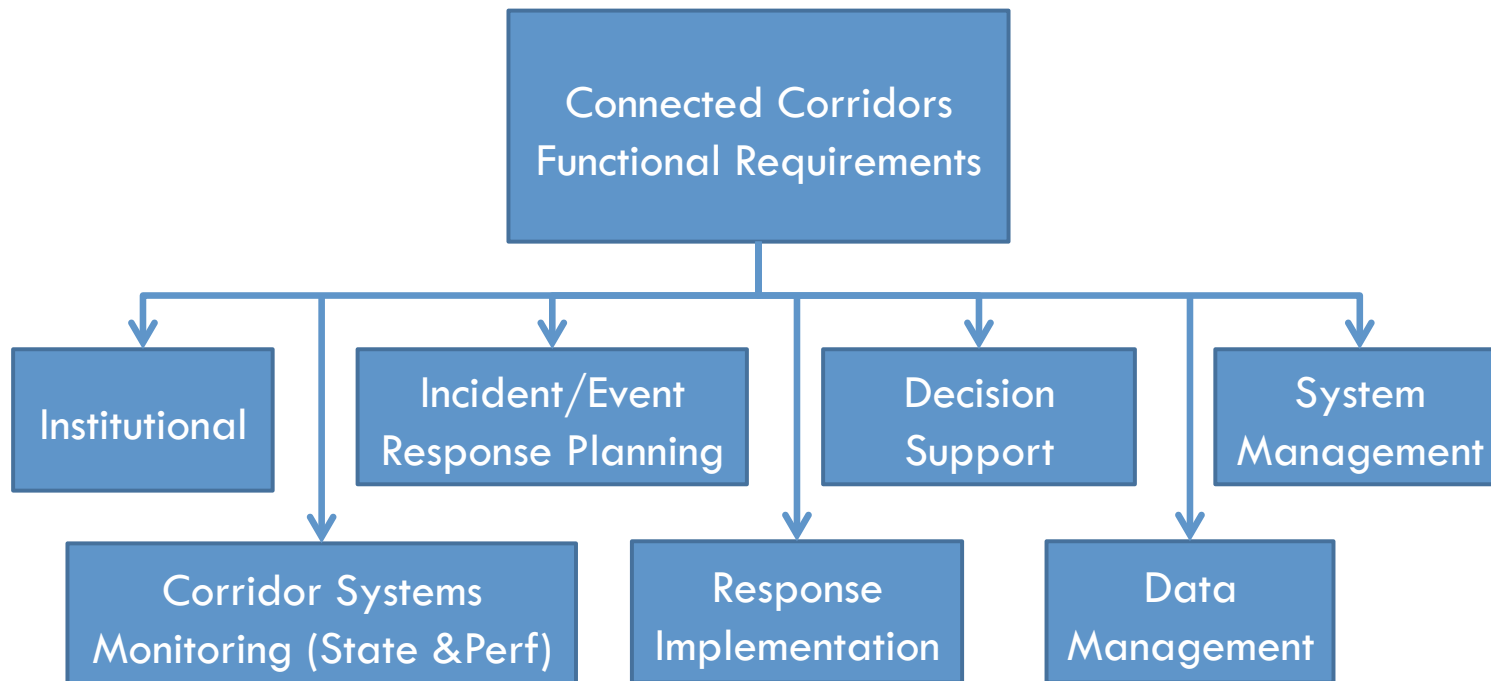
27

- ❑ **Institutional**
- ❑ **Corridor Systems Monitoring**
- ❑ **Incident/Event Response Planning**
- ❑ **Response Implementation**
- ❑ **Decision Support**
- ❑ **Data Management**
- ❑ **System Management**



Functional Requirements

28



Requirements Document

29



Current Status – Initial Requirements Meetings

30

□ Cities and County

- ▣ Arcadia
- ▣ Pasadena

□ Caltrans D7

- ▣ Maintenance
- ▣ Ramps
- ▣ Signals
- ▣ TMT & LCS
- ▣ TMC Operators
- ▣ TMC Support

□ Caltrans HQ

- ▣ Maintenance
- ▣ PEMS
- ▣ Signals
- ▣ TMT & LCS
- ▣ Office of Technology

□ Metro

- ▣ Transit

□ SCAG

- ▣ Planning



Requirement Activities since last Face-to-Face

- **Meetings at ITS California**
 - ▣ 511 – Introduced ourselves to Iain Fairweather and attended 511 meeting
 - ▣ RIITS – Met with Kali Fogel for 45 minutes
- **Document Review**
 - ▣ Reviewed 511 documents provided by Iain
 - ▣ Reviewed RIITS documents provided by Kali
- **Duarte - First meeting on 10/8**
- **Joint 511 and RIITS meeting held on 10/8**
- **Met with Caltrans Office of Technology on 10/22. Established bi-weekly meetings**
- **Wrote up and distributed half of original requirements interviews**



Planned Meetings

32

□ Planned

- ▣ Duarte - Follow up meeting on 10/29 including Public Safety Officer
- ▣ Monrovia - Meeting on 10/29 (Tina Cherry plus City Engineer and Traffic Maintenance Supervisor)
- ▣ Metro Transit – Meeting on 10/28
- ▣ Pasadena Transit – Meeting on 10/28
- ▣ Caltrans Office of Technology – Every Two Weeks

□ To be setup

- ▣ Meeting with LA County
- ▣ Meeting with corridor wide first responders
- ▣ Meeting with corridor wide signal engineers
- ▣ Meetings with specific departments in Pasadena
- ▣ Meetings with specific departments in Arcadia



Next Steps

33

- **Hold additional meetings**
- **Continue to document interview results**
- **Distribute initial documentation for review**
- **Generate requirements for review in late December**
- **Complete requirement approvals by March**



Architecture and Constraints



High-level Architecture

35



Question – Verdugo Fire Center

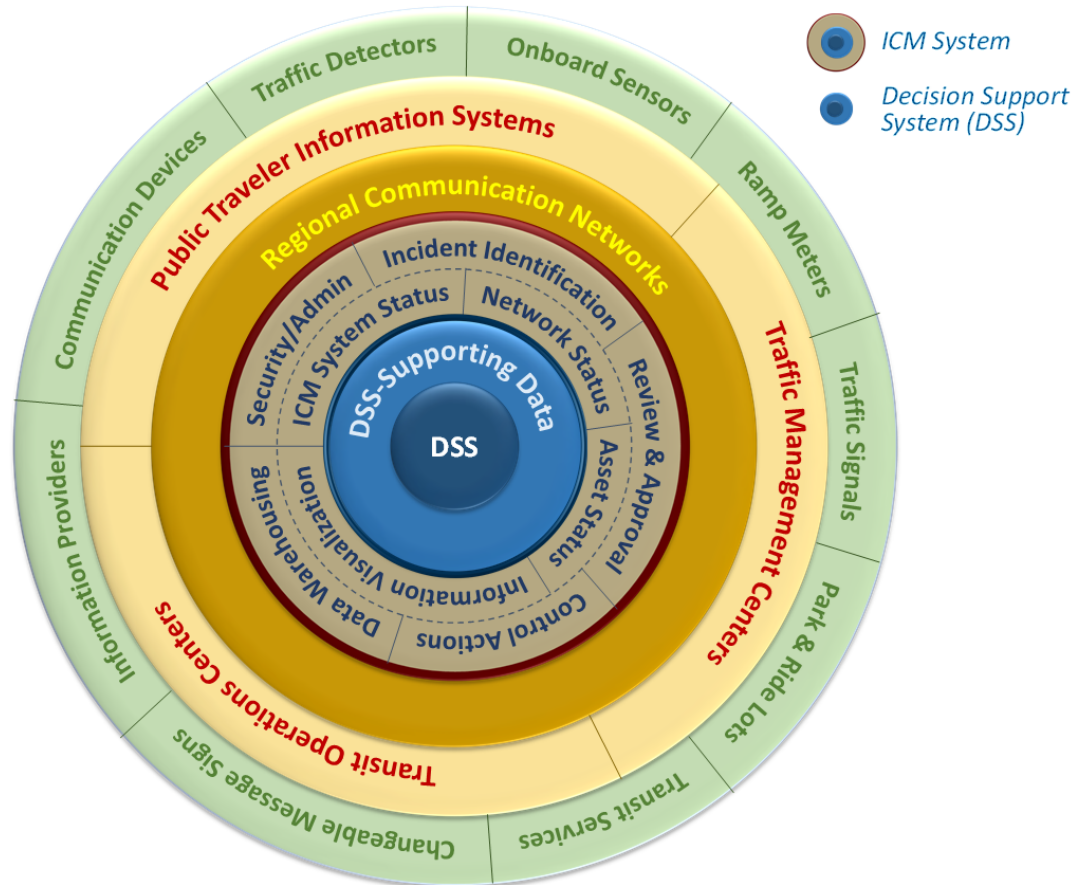
36

- ☐ Is this an interface that we need to add to our diagram?
- ☐ If so, what information flows to and from it?



System Components

37



Design Constraints

38

□ Considerations

- ▣ Maintain consistency with the LA County Regional ITS Architecture
- ▣ Maintain consistency with Caltrans Strategic Systems
- ▣ Maintain consistency with existing and planned organizational structures

□ Existing systems/interfaces

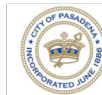
- ▣ Information Exchange Network (IEN) – LA County DPW
- ▣ Regional Integration of ITS (RIITS) – Metro
- ▣ 511 – Metro
- ▣ PEMS (Performance Management System) – Caltrans
- ▣ Caltrans Reorganization around Corridors



Arterial System Schedule

39

- | | |
|---|----------------------|
| <input type="checkbox"/> Duarte and Monrovia on KITS | Completed |
| <input type="checkbox"/> County to bring KITS onto IEN | December 2015 |
| <input type="checkbox"/> IEN Contractor Selection | Spring 2016 |
| <input type="checkbox"/> Pasadena i2 intersection change-over | December 2016 |
| <input type="checkbox"/> Caltrans Signals on TSMSS | June 2017 |
| <input type="checkbox"/> IEN Replacement System operational | October 2017 |



Other System Schedules

40

□ **Metro go511 Upgrade**

- Issue RFP October 2015
- Upgraded system installed November 2016

□ **Metro RIITS Upgrade**

- Issue RIITS Modernization RFP October 2015

□ **Caltrans**

- 210 Improvements June 2017
- DCCM Dec 2016
- Organizing around Corridors 2016
- PEMS Updates TBD

□ **Metro**

- Call for Projects Approval Sept 2015
- Projects to begin in 2016 TBD



Constraint Questions

41

- **Are there constraints on who is responsible for interfaces with media (radio, TV, general media)**
 - ▣ 511?, Caltrans media office, others?
- **Are there constraints on who is responsible for interfacing with third party providers to obtain data such as Inrix, Here, Waze?**
 - ▣ Regional, Statewide ?
- **Are there constraints on who is responsible for providing data to third parties such as Waze, Here, Inrix, etc**
 - ▣ Regional, Statewide ?



Decision Support and AMS



Decision Support

43

- **Key Principle:** Decisions will be based on measureable, quality data
- **Decision Support needed for:**
 - ▣ Determining data quality on the corridor
 - ▣ Planning incident responses
 - ▣ Choosing incident responses in real time
 - ▣ Post incident analysis
- **Decision Support includes:**
 - ▣ Data Analysis Tools – PEMS and other Berkeley tools
 - ▣ Signal Synchronization Tools – Synchro and possibly others like TranSync
 - ▣ Micro/Meso Modeling – Aimsun and others
 - ▣ Macro models based on traffic (not behavioral) data – CC tools
 - ▣ Rules Engines for incorporating static rules (School in session for example) – Potentially DCCM work and or D4 systems



Decision Support – Modeling Status

44

□ Integrating aspects of the following modeling tools:

□ Synchro Corridor Model

- Model used for traffic signal operational analyses
- Developed models representing 8 AM and 5 PM signal control operations
- Based on most recent traffic counts and timing sheets provided by local agencies (as April 2014)

□ Aimsun Corridor model (*in development*)

- Exploring how Aimsun could be used to help evaluation corridor aspects
- Based on road geometry imported from Synchro, with some adjustments
- Small networks could be extracted and set up relatively easily
- Challenge is how to define the demand to be simulated if using whole corridor

□ Connected Corridors Simulation Model (*in development*)

- Highway model – Ability to replicate a given day (demonstrated ability to meet FHWA calibration standards)
- Arterial model – Can simulate dual-ring operations with projected phasing

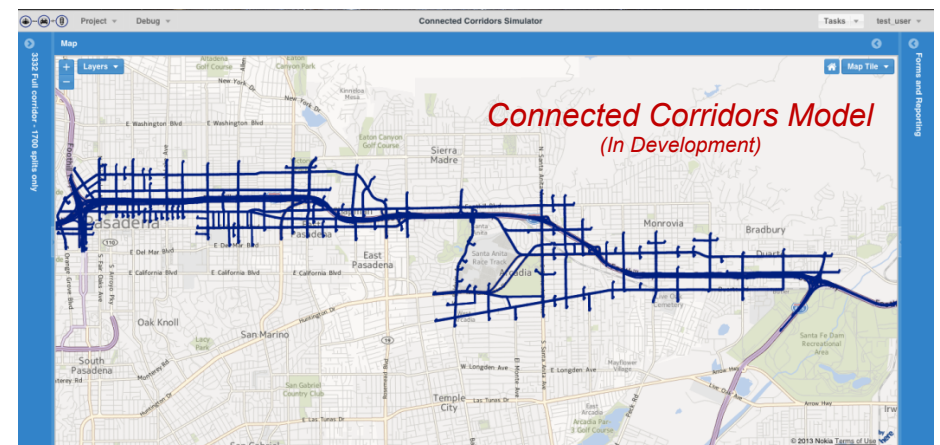
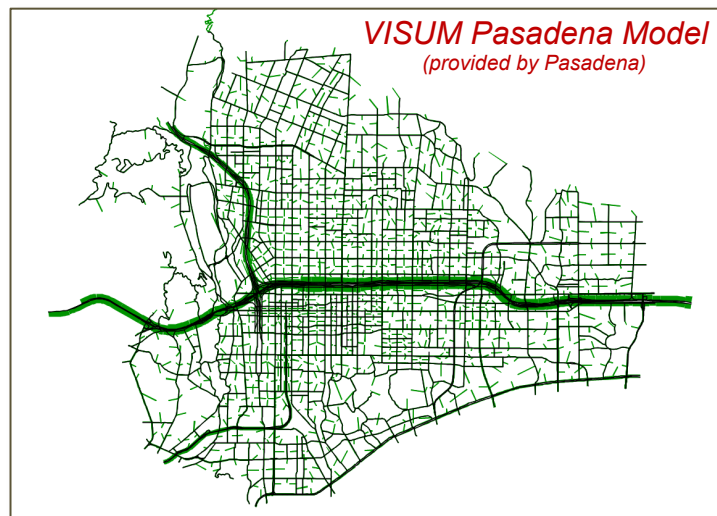
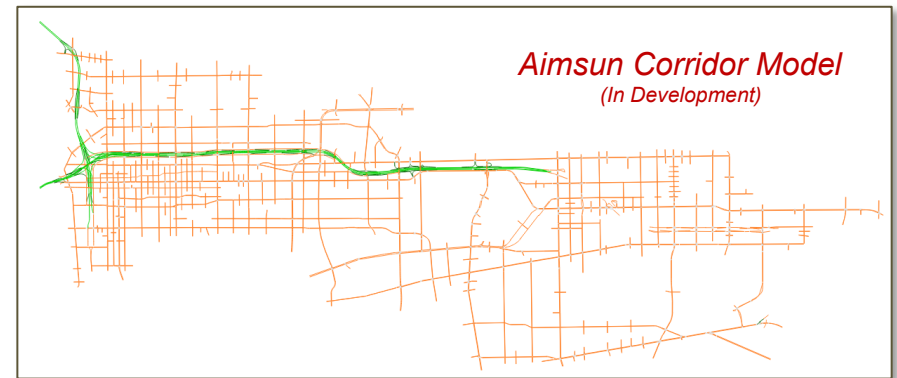
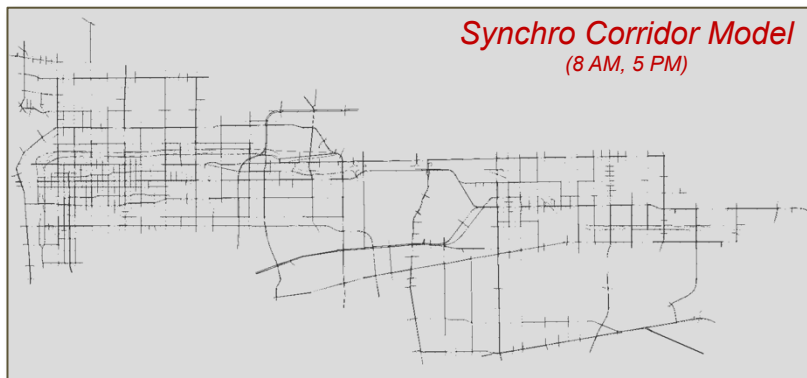
□ Pasadena VISUM Dynamic Traffic Assignment Model

- Exploring how to use model to extract travel demand information



Models used as part of I-210 Pilot

45



I-210 Incident Response Plans

46

□ Approach

▣ Characterization of incidents by type

- Minor – Moderate – Major
- Freeway – Arterial – Transit

▣ Automated Response Components

- Freeway ramp metering & ramp signal operations
- Local arterial signal operations (designated routes only)

▣ Rules-Based Responses

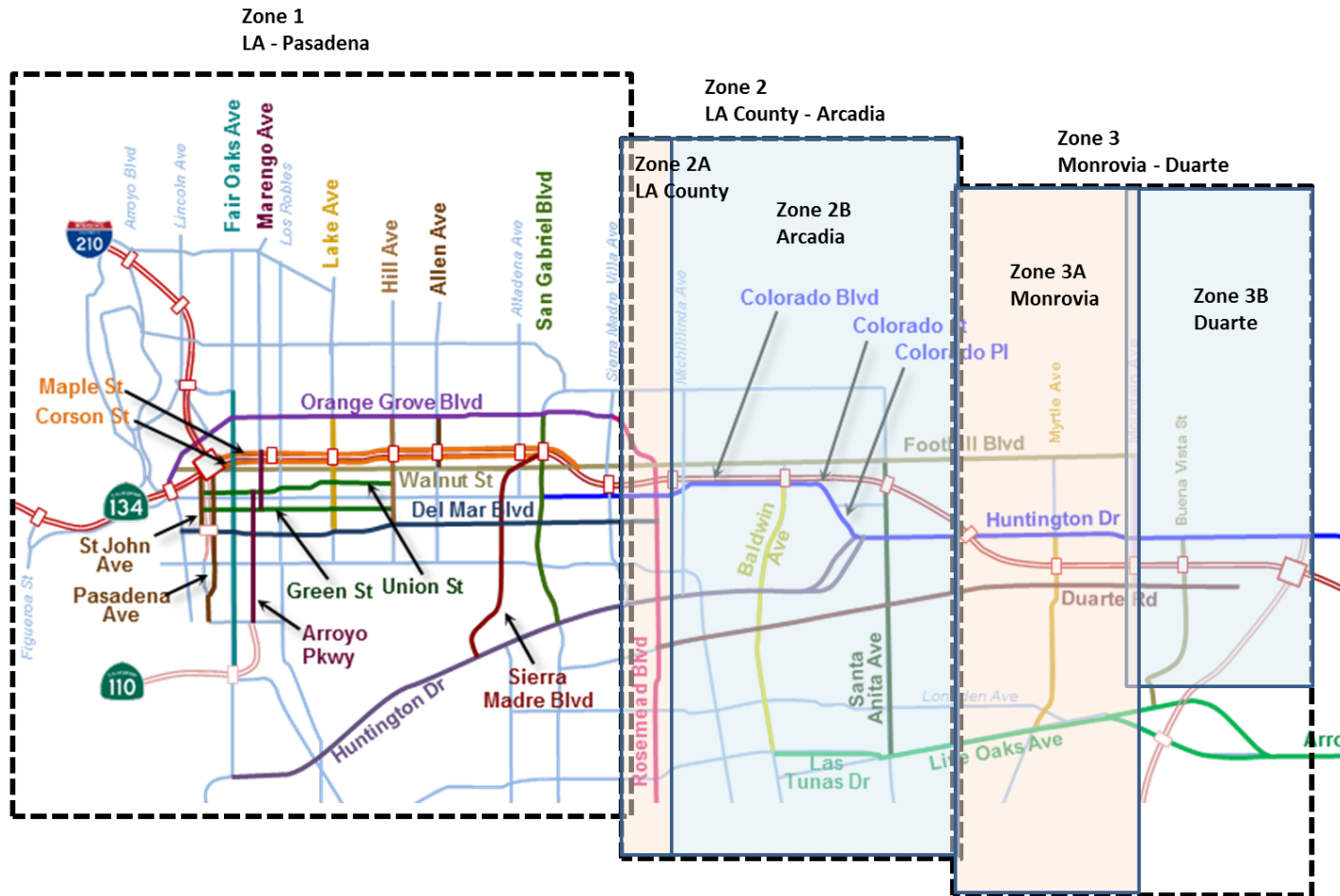
- Selection of alternative routes
- Signal timing plans to implement

▣ Restrictive factors to consider

- Major events and activity centers
- Schools and other high pedestrian activity areas (senior centers, rec centers, etc.)
- Businesses and residents
- Bikes, pedestrians, transit grade crossings

Influence Zones

47



Response Example

48

- ❑ **Major Incident** on I-210 EB between Lake and Hill (Zone 1 only)
- ❑ **Response Example**
 - ▣ Divert to Orange Grove, Green, and Del Mar
 - ▣ Divert SB-210 to Mountain to Fair Oaks to Orange Grove
 - ▣ Increase metering rate at four downstream on-ramps
 - ▣ Reduce metering to minimum at three upstream on-ramps



Rules-Based Response Plan Example

49

□ Freeway Minor Incident (initial script)

- Reduce metering rate at ramps within 2 miles upstream
 - 50% reduction to start (adjust as needed)
 - Reduce green time to ramp intersection signal movements to on-ramps
- Increase metering rate at ramps within 2 miles downstream
 - 50% increase to start (adjust as needed)
 - More green time to ramp I/S signal movements to access on-ramps
- Increase metering rate at opposite direction ramps within 1 mile
 - 25% increase to start (adjust as needed)
- Alternative routes along local arterials
 - More green time for arterial I/S signals thru movements to downstream ramps
 - Factors to consider (for restrictive days/hours on select corridors)

Rules-Based Response Example

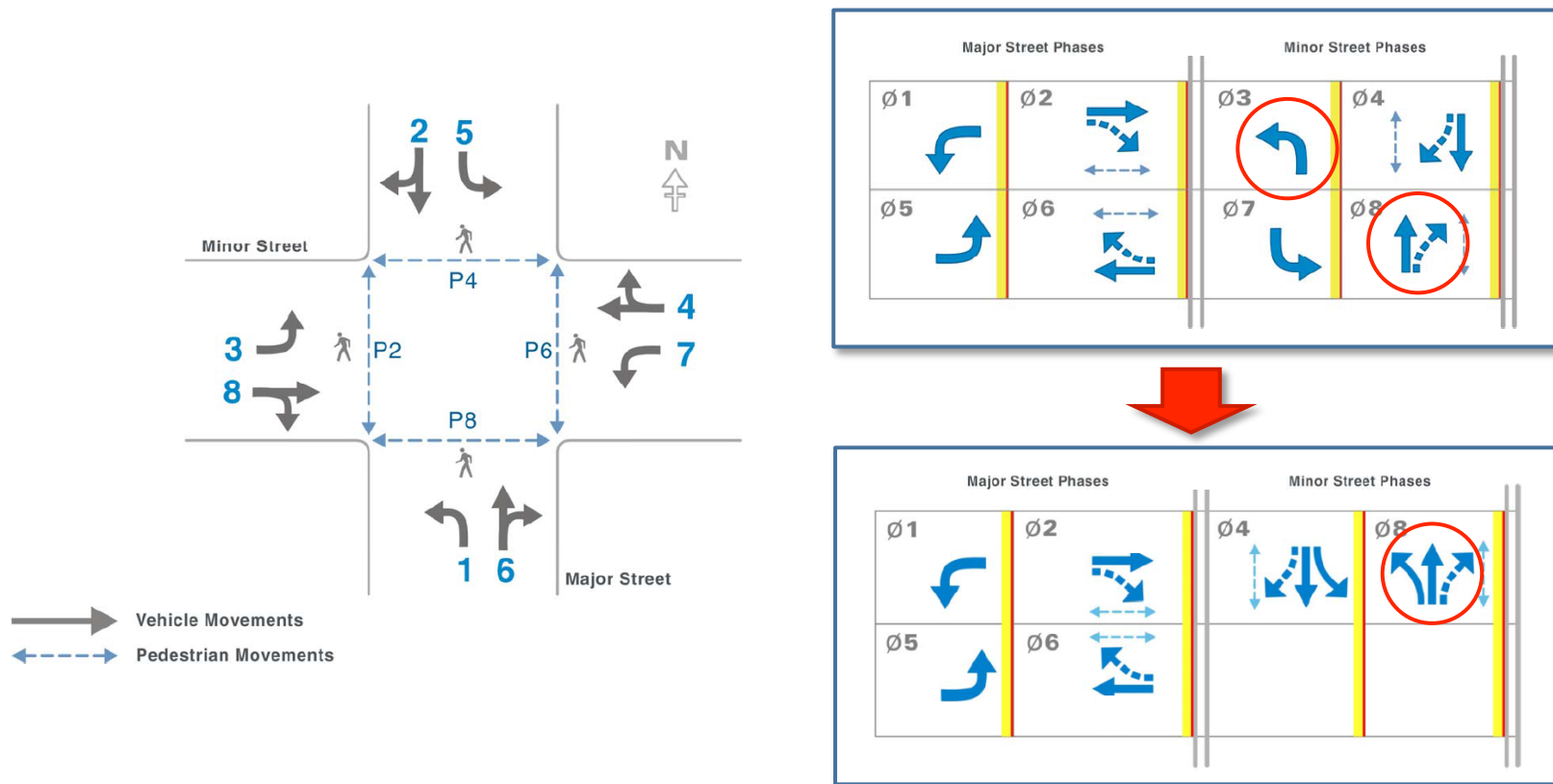
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- **Local arterial signal modification plans (initial script)**
 - ▣ **Minor incidents** (nominal level changes)
 - Same signal phases as normal operations
 - More green time to favored movement(s), as needed
 - Local optional route(s); optional cycle lengths
 - ▣ **Medium incidents** (moderate level changes)
 - Additional optional routes
 - Modify signal phases to allow for more green time to favored movement(s) (e.g. eliminate some phases)
 - Modify signal phases/green times to deter non-essential movementw towards signalized intersections downstream of incident

Rules-Based Response Plan Example

51

- Example of signal timing change for **medium or high level** response



Rules-Based Response Plan Example

52

- **Local arterial signal modification plans (initial script)**
 - ▣ **Major incidents** (aggressive level changes)
 - All nearby arterials will quickly be saturated and overloaded (extreme conditions)
 - Move as much pass-through traffic out of the area as quickly as possible
 - Minimal signal phases to allow for more green time to favored movement(s)
 - Modify signal phases/green times to deter non-essential movements towards intersections downstream of incident

I-210 CC Incident Response Plans

53

□ Next Steps

□ What the Team is working on

- Team to develop conceptual rules based response plans
- Team to propose initial details of
 - Alternate routes
 - Metering rates on freeway ramps upstream and downstream of incidents
 - Signal timing changes along target routes

□ Meeting with all local jurisdictions

- Need list of restrictions (e.g., school ped traffic) from each agency
- Discuss proposed change options

Evaluation Framework



Before/After Study Technical Memo

55

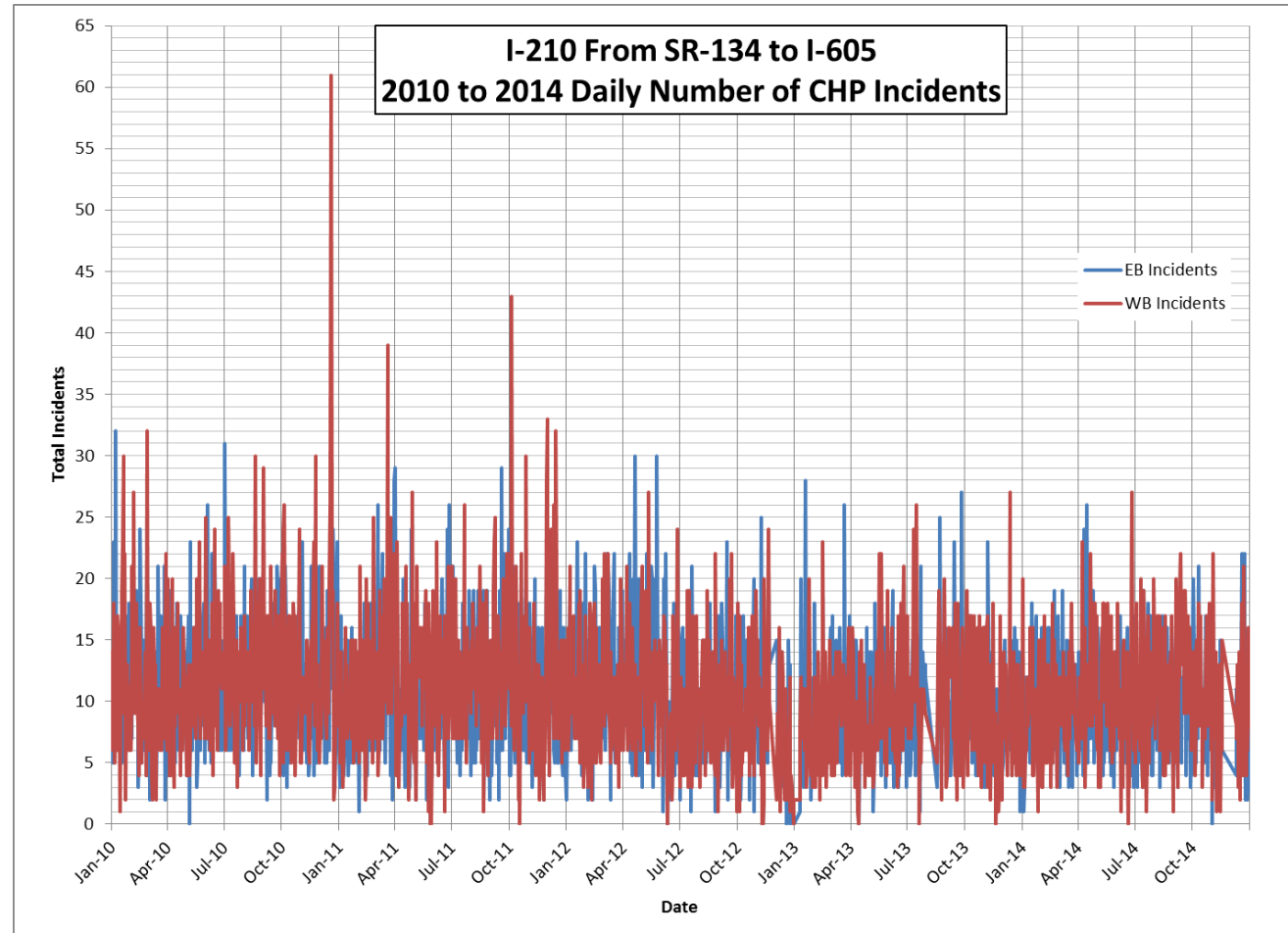
- Ready for review by all stakeholders
 - ▣ Evaluation approach and methodology
 - ▣ Metrics
 - ▣ Data collection needs
- We will email to all of our stakeholders
- Please review and comment before the next face to face
- We hope to collect data during the first part of next year



Why “Significant” Non-Recurrent Congestion

56

**Not many
incident-free
days**



Action Items and Next Meeting Time



**Thank
You**

